

**Title:** Habitat modeling of Atlantic blue marlin with SEAPODYM and satellite tags

**Principal Investigator(s):**

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**Goals:** The use of habitat modeling is becoming a common approach for standardization of CPUE allowing one to incorporate environmental influences on the distribution of fishes (ICCAT 2004). We are modeling the habitat of Atlantic blue marlin using an approach developed for a Spatial Ecosystem And Populations Dynamics Model (SEAPODYM). The model will be calibrated and evaluated using fishing data and electronic tagging data. While the results will be useful for CPUE standardization, they will also provide the first step toward a full application of SEAPODYM to investigate spatial population dynamics of blue marlin and to develop stock assessment studies.

**Approach:** Our study is aimed at identifying the main sources of variability of Atlantic blue marlin habitats and spatial dynamics, through the combined use of a state of the art ecosystem model and movement data from electronic tags. The increased availability of recent data on the ocean scale movements for blue marlin using electronic tags facilitated our species selection process. SEAPODYM is the main tool to achieve the goals of this project. This model was developed to simulate the spatial dynamics of tuna populations in the pelagic ecosystem. It uses bio-physical environmental fields to simulate the upper trophic levels of marine ecosystem organized in two groups: the tunas or associated species and their prey species of the mid-trophic levels (i.e. micronekton). Modeling the habitat and vertical structure of micronekton distribution, as well as the age-structured spatial dynamics of tuna (through an advection-diffusion framework) is based on first biological principles, such as thermal habitat, oxygen tolerance, prey and predator interactions. The parameterization of these components defines a movement index with seasonal switching between feeding and spawning habitats, defining in turn the spatial dynamics of the target species. The emphasis of this one-year project will be put on defining the feeding habitat, based on mechanisms developed in the model for other tuna species, in order to recreate the key movement patterns of individuals, as described by archival tags. A review covering biology, ecology, fisheries and population structure of Atlantic blue marlin will be conducted to gather all the necessary information needed to parameterize the model SEAPODYM for a second phase study. Finally, a statistical analysis will help to investigate the link between CPUE and predicted habitat.

**Work Completed:**

Some time that would have normally been spent for this project was taken up responding to the recent DWH disaster. With the immediate response to that event winding down, the project is now poised to get underway with greater momentum. To date, the following has been accomplished:

- Met with Patrick Lehody and discussed model details, requirements, and modeling strategy. A liaison from Dr. Lehody's lab has also been assigned to help with the modeling.
- Literature review of the biological for appropriate parameterization of model
- Model has been set-up two different ways on the SEFSC network for beta testing
- The three U.S.-based authors met to discuss various aspects of the project. All files from the literature review were shared, the latest version of the model and the associated habitat files were shared, and strategies for meeting the goals of the project were discussed. The contractor (Dr. Jiangang) has successfully set up the model as well and has the example data running with consistency.
- Our next mid-term goals are to obtain the fishing dataset and the tagging dataset.
- The Principle investigator is now involved in the ICCAT blue marlin assessment in 2011 which will use more standard stock assessment model (Stock Synthesis) for comparison to the SEAPODYM results.

#### **Applications:**

The SEAPODYM model will provide an estimate of the spatial distribution of blue marlin habitat. This estimated distribution will be a new piece of information not currently available to ICCAT. This study is also a preparatory phase to investigate in more detail the spatial population dynamics of blue marlin and to develop stock assessments studies with a new generation of model not yet used by ICCAT, and that can be compared to other stock assessment models estimates.

#### **Publications/Presentations/Webpages:**

Two presentations were made to the International Commission for the Conservation of Atlantic Tuna (ICCAT) Sub-Committee on Ecosystems. One by Dr. Patrick Lehody, who presented the SEAPODYM model in general and how it can be used in habitat modeling, and another by Dr. Michael Schirripa who spoke more specifically about the blue marlin application using the satellite tagging data.